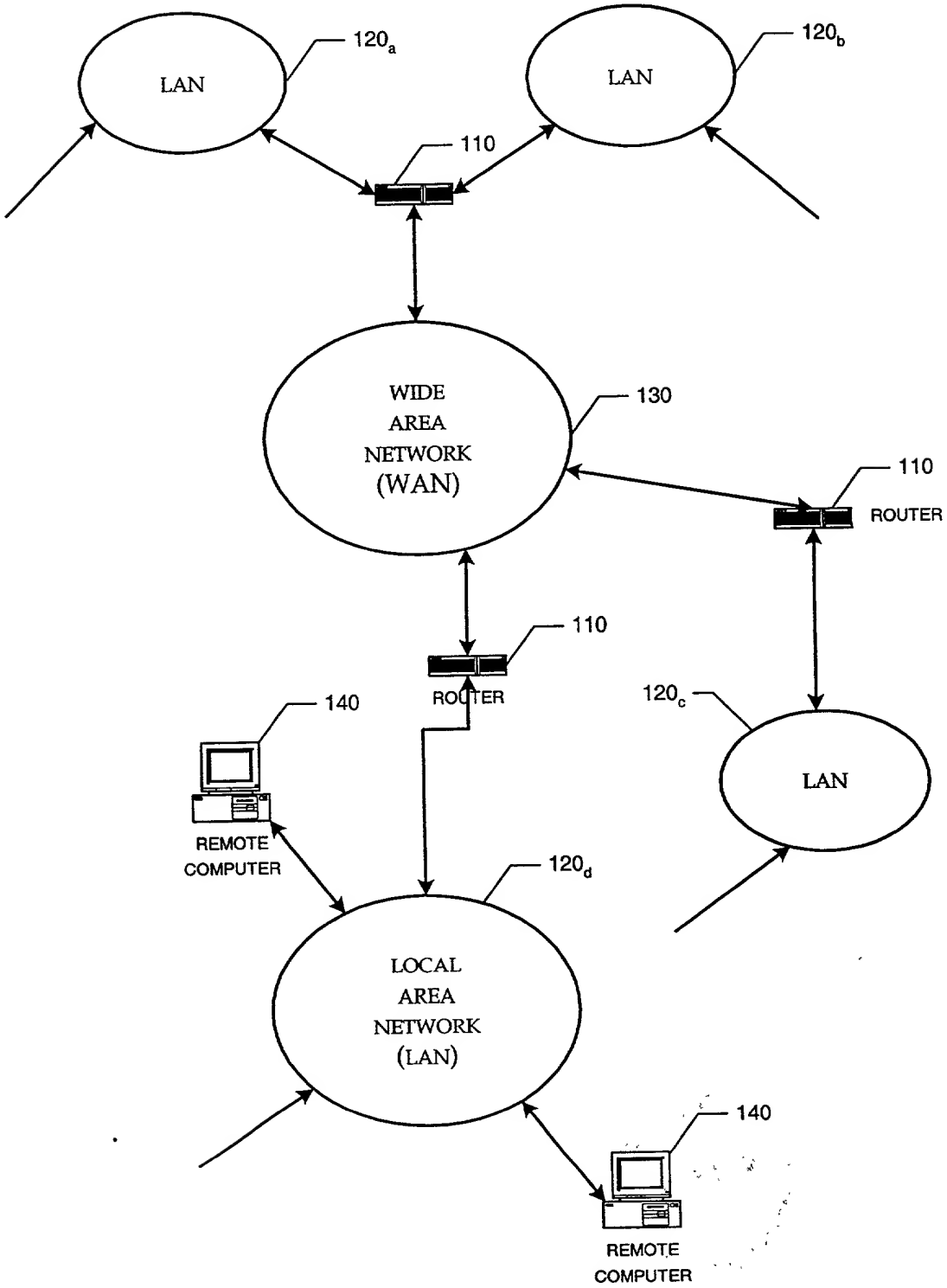

LAN
120a
LAN
120b
110
WIDE
AREA
NETWORK
(WAN)
130
110
ROUTER
110
ROUTER
140
120c
LAN
REMOTE
COMPUTER
120d
LOCAL
AREA
NETWORK
(LAN)
140
REMOTE
COMPUTER
100

Fig.1

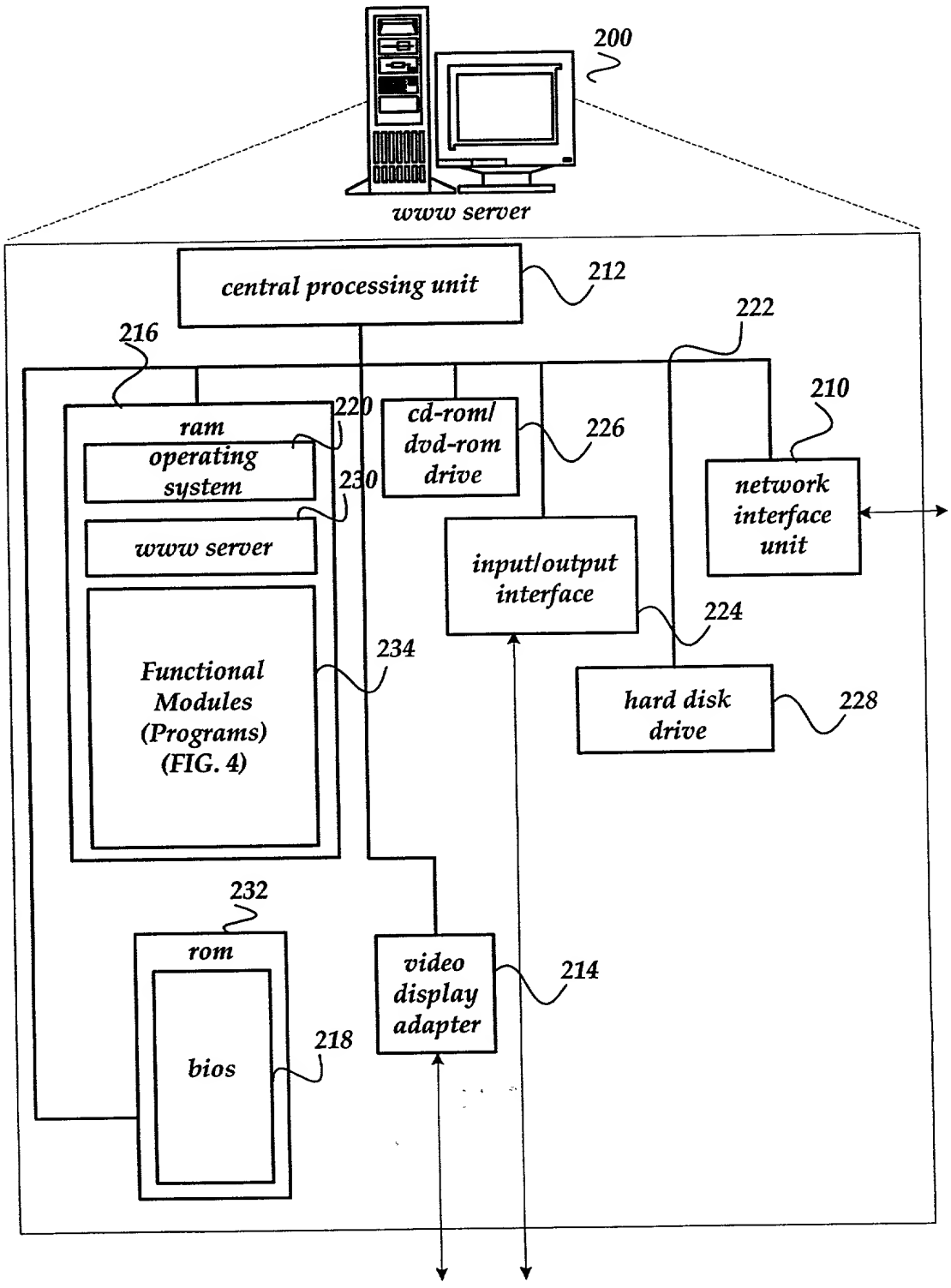

200
www server
central processing unit
212
222
216
210
ram
operating system
220
cd-rom/ dvd-rom drive
226
network interface unit
230
www server
input/output interface
224
Functional Modules (Programs) (FIG. 4)
234
hard disk drive
228
232
rom
video display adapter
214
bios
218

Fig.2

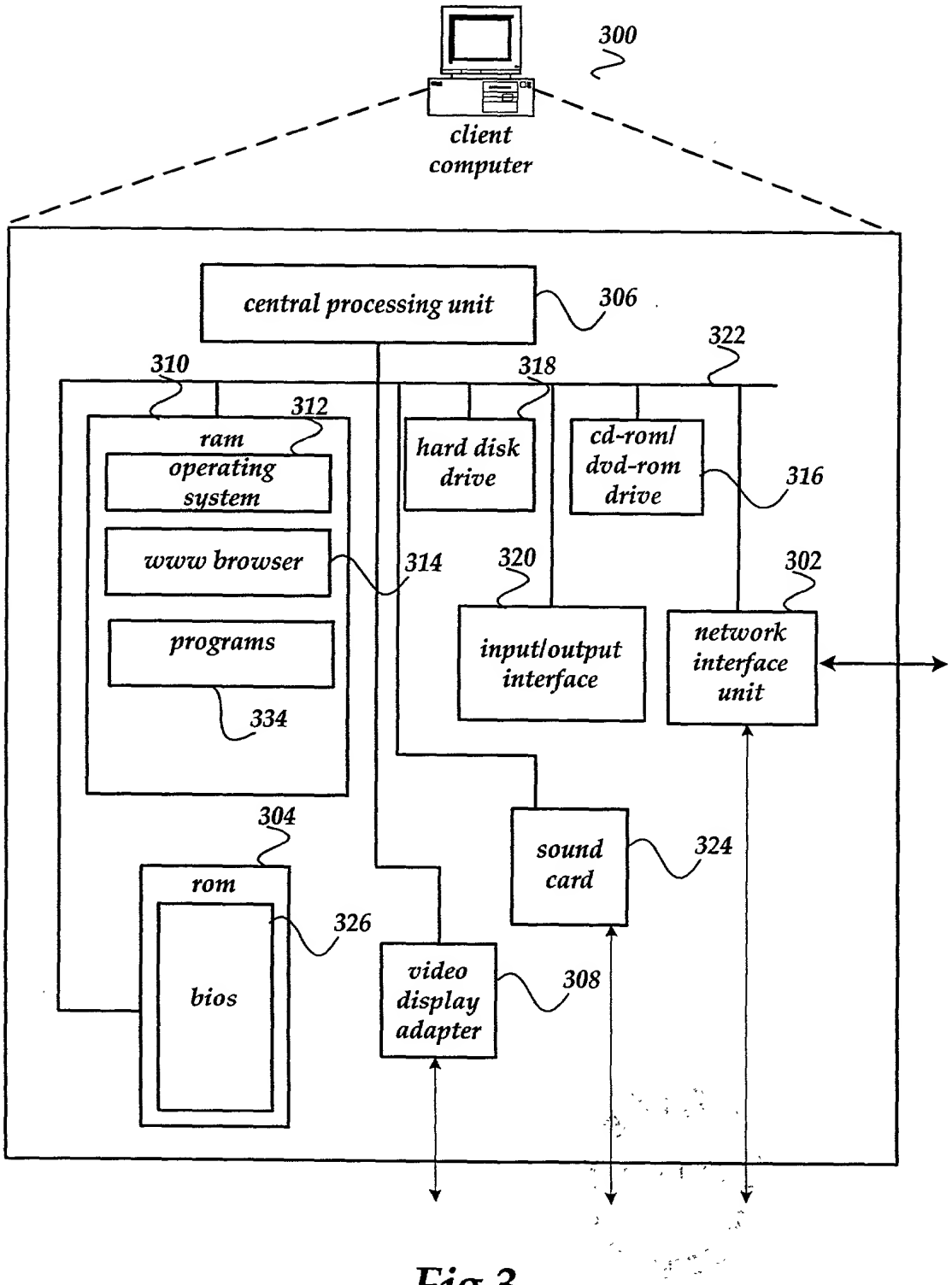

300
client computer
central processing unit
306
322
310
318
312
ram
operating system
hard disk drive
cd-rom/ dvd-rom drive
316
www browser
314
320
302
programs
input/output interface
network interface unit
334
304
sound card
324
rom
326
bios
video display adapter
308

Fig.3

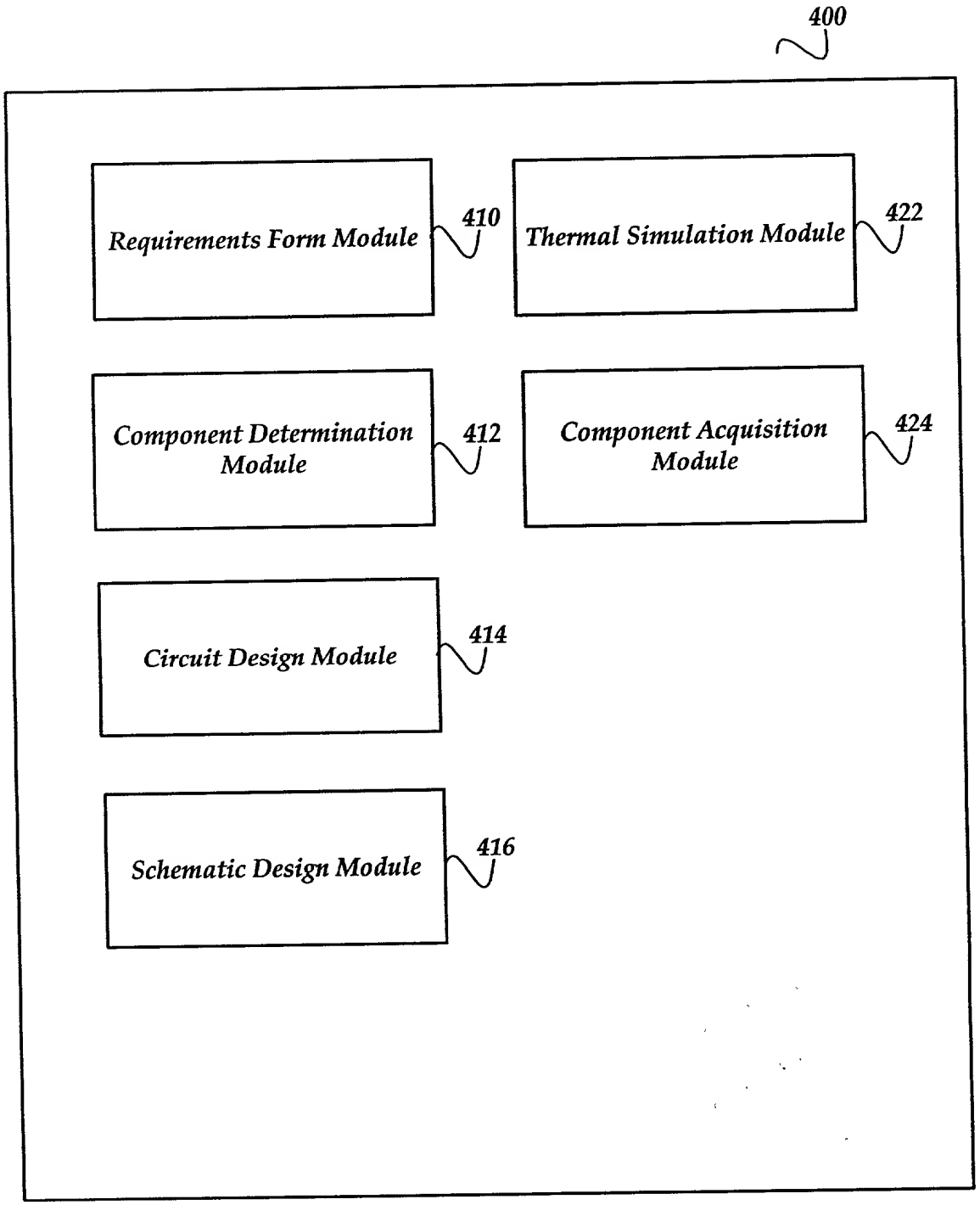

400
Requirements Form Module
410
Thermal Simulation Module
422
Component Determination Module
412
Component Acquisition Module
424
Circuit Design Module
414
Schematic Design Module
416

Fig.4

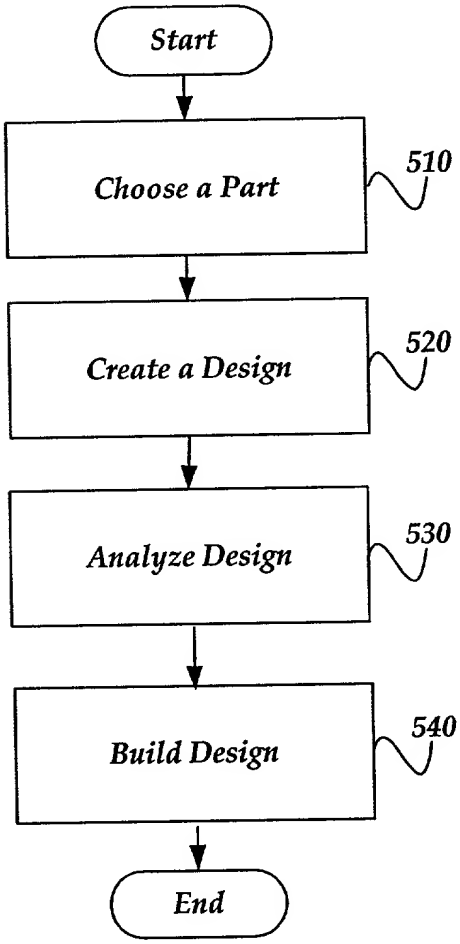
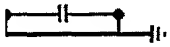

Start
Choose a Part
510
Create a Design
520
Analyze Design
530
Build Design
540
End

Fig.5

Title: METHOD TO PERFORM THERMAL SIMULATION OF AN ELECTRONIC CIRCUIT ON A NETWORK
Inventors: Rex Allison; Martin Garrison; Jeffrey Perry
Docket No.: 50019.44US01/P04884



Welcome to your Power Webench™!

"Tools for the power design engineer"

START HERE ~605
to design a power supply.

How to Use Webench

Just four easy steps to design a power supply! Just click on the items below for help on that step.

610

620 **1 Choose a Part** choose a specific part or input your system specifications to find those devices that fit.

630 **2 Create a Design** a design will be created for you including any necessary passive components and important calculated operating values.

640 **3 Analyze a Design** use WebSim™, the online power simulator, to validate your design electrically, and WebTHERM™, the online thermal simulator to visualize the thermal behavior of your design.

650 **4 Build It!** buy a part, a kit of parts, or an evaluation board.

See Our Disclaimer

Features

WebSIM™ is a browser-based simulator which allows you to probe points in the

My Designs

Your last 4 designs: ~660
- Design#6
- Design#5
- Design#4
- Design#3

MY**Designs** Shows all of your Designs ~670

My WebSIM™ Simulations ~680

My WebTHERM™ Simulations ~690

My BuildIt Orders ~695

Other Power Webench Tools

Switchers Made Simple™ is downloadable software that enables you to develop a complete power supply design on your local PC. This covers Simple Switcher devices and includes discrete component and manufacturer selection.

- SMS 6.1 (for LM267x and LM259x buck regulators, and LM258x and LM2577 boost & flyback regulators) **Updated!**
- SMS 3.3 (for LM257X)

Wireless Webench Tools

- Wireless Easy PLL Design Assistant

FIG. 6

Title: METHOD TO PERFORM THERMAL SIMULATION OF AN ELECTRONIC CIRCUIT ON A NETWORK
Inventors: Rex Allison; Martin Garrison; Jeffrey Perry
Docket No.: 50019.44US01/P04884

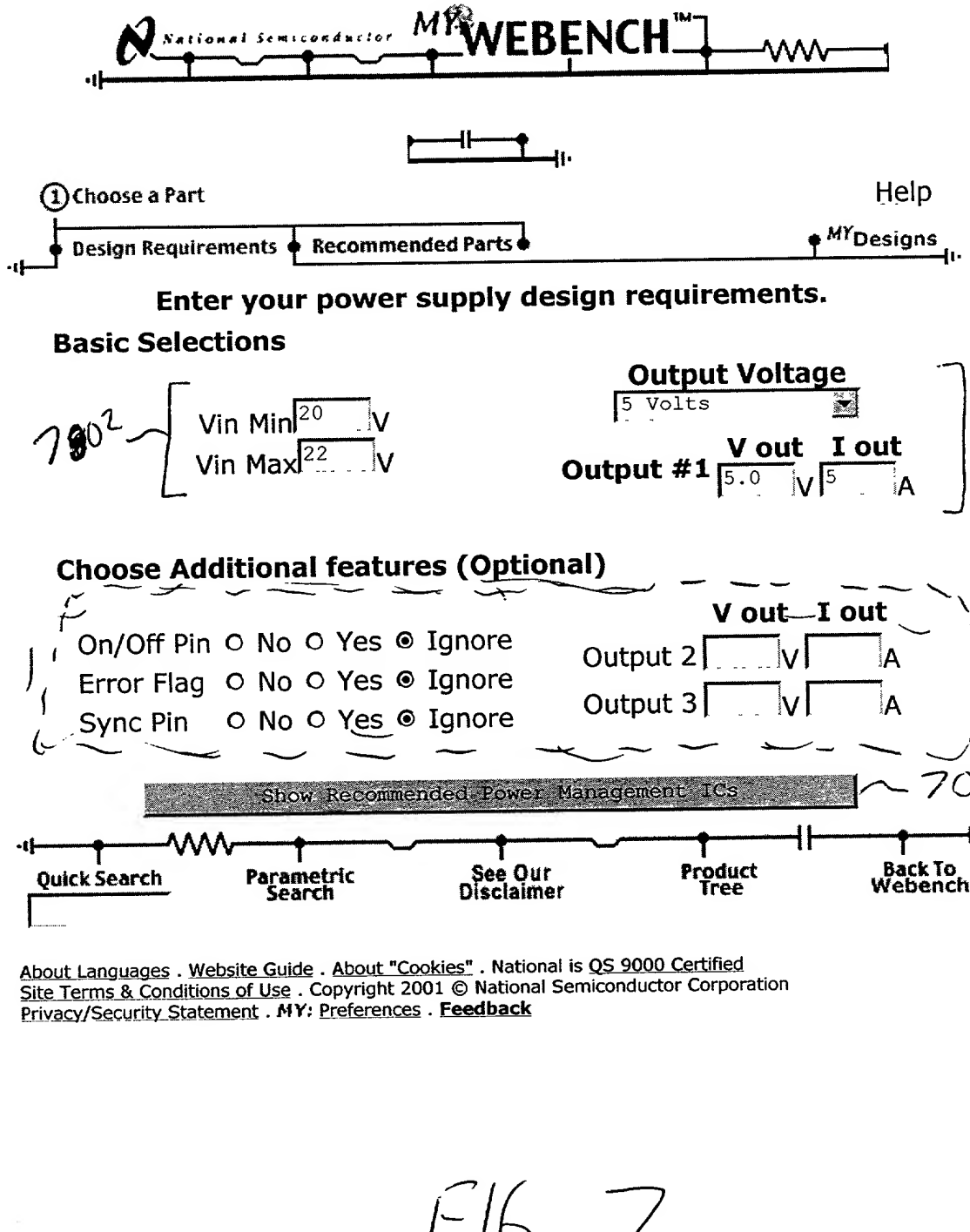
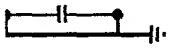


FIG. 7



Your Design Specifications

VinMin: 20.0V VinMax: 22.0V	Output #1 Vout= 5.0V Iout= 5.0A

Suggested Switching Regulators - Buck Topology

Product Folder	Webench Tools	Max Curr.	Typ. Eff.	On/Off	Err. Pin	Other Features	Freq. kHz	Est. Price
LM2678-5.0	Create Design WebTHERM™ enabled Build It - Custom Kit	5.0A	84%	Y	Y		260	$3.84
LM2678-ADJ	Create Design WebTHERM™ enabled Build It - Custom Kit	5.0A	84%	Y	Y	Adj. Vout	260	$3.84
LM2679-5.0	Create Design WebTHERM™ enabled Build It - Custom Kit	5.0A	84%	Y	Y	SoftStart, Adj. Peak Current Limit	260	$4.07
LM2679-ADJ	Create Design WebTHERM™ enabled Build It - Custom Kit	5.0A	84%	Y	Y	SoftStart, Adj. Peak Current Limit, Adj. Vout	260	$4.07

Suggested Switching Regulators - Flyback Topology

Product Folder	Webench Tools	Max Curr.	Typ. Eff.	On/Off	Err. Pin	Other Features	Freq. kHz	Est. Price
LM2585-5.0	Create Design	3.0A	93%	N	N	SoftStart	100	$3.42
LM2585-ADJ	Create Design	3.0A	80%	N	N	SoftStart, Adj. Vout	100	$3.42
LM2586-5.0	Create Design	3.0A	80%	Y	N	Sync, SoftStart	100	$3.45
LM2586-ADJ	Create Design	3.0A	80%	Y	N	Sync, SoftStart, Adj. Vout	100	$3.45
LM2587-5.0	Create Design	5.0A	80%	N	N	SoftStart	100	$4.51
LM2587-ADJ	Create Design	5.0A	80%	N	N	SoftStart, Adj. Vout	100	$4.51
LM2588-5.0	Create Design	5.0A	80%	Y	N	Sync, SoftStart	100	$4.61
LM2588-ADJ	Create Design	5.0A	80%	Y	N	Sync, SoftStart, Adj. Vout	100	$4.61
LM2577-ADJ	Create Design	3.0A	80%	N	N	SoftStart, Adj. Vout	52	$3.15

FIG. 8

Title: METHOD TO PERFORM THERMAL SIMULATION OF AN ELECTRONIC CIRCUIT ON A NETWORK
Inventors: Rex Allison; Martin Garrison; Jeffrey Perry
Docket No.: 50019.44US01/P04884

National Semiconductor
The Sight & Sound of Information

Design · Purchasing · Quality · Company · Jobs

Products > Analog - Regulators > Simple Switchers > LM2679

Product Folder

905

Live Simulation

Buy LM2679-5.0 Evaluation Board

LM2679 SIMPLE SWITCHER 5A Step-Down Voltage Regulator with Adjustable Current Limit

Generic P/N 2679

Contents

902

Parametric Table	
Multiple Output Capability	No
On/Off Pin	Yes
Error Flag	Yes
Input Voltage, min (Volt)	8,15
Input Voltage, max (Volt)	40
Output Current, max	5 Amps
Output Voltage (Volt)	5,12,3.30
Adjustable Output Voltage	No,Yes
Switching Frequency (Hz)	260000
Adjustable Switching Frequency	No
Sync Pin	No
Efficiency (%)	84,92,82
Flyback	No
Step-up	No
Step-down	Yes

904

FIG. 9

Title: METHOD TO PERFORM THERMAL SIMULATION OF AN ELECTRONIC CIRCUIT ON A NETWORK
Inventors: Rex Allison; Martin Garrison; Jeffrey Perry
Docket No.: 50019.44US01/P04884

1006 1014

1 Choose a Part | 2 Create a Design | 3 Analyze a Design | 4 Build It!

Help

Components | Operating Values | Schematic 1008 | MY Designs

Design: Design#7
Device: LM2679 Mar 17 2001 3:39PM ID: 266796_7

Design Requirements Output #1
VinMin = 20.00 V Vout= 5.00 V
VinMax = 22.00 V Iout= 5.00 A

Choose Operation
Copy
Rename, Add Notes
Print,XML
Share this Design

1004

1010 1012

Webtherm - Thermal Simulation **Websim - Electrical Simulation**

Components

Part	Manufacturer	Part#	Attributes	Thermally Modelled*	
Cb	Vishay-Vitramon	VJ1206Y103KXAAT	0.0100 uF	Y	Select Alternate Part
Cin	Vishay-Sprague	594D156X0035D2T	NumCaps=3 15.000 uF,0.2650 Ohms		Select Alternate Part
Cout	Vishay-Sprague	594D187X0016R2T	NumCaps=1 180.00 uF,0.0650 Ohms		Select Alternate Part
Css	Vishay-Vitramon	VJ1206A392JXAAT	0.0039 uF	Y	Select Alternate Part
D1	International Rectifier	6CWQ03FN	0.450000 V		Select Alternate Part
IC	National Semiconductor	LM2679S-ADJ	ADJV,Buck		Select Alternate Part
L1	Coiltronics	UP4B-150	15.000 uH,0.0200 Ohms		Select Alternate Part
Rfb1	Vishay-Dale	CRCW1206-1001FRT1	1000 Ohms	Y	Select Alternate Part
Rfb2	Vishay-Dale	CRCW1206-3161FRT1	3160 Ohms	Y	Select Alternate Part
Rilim	Vishay-Dale	CRCW1206-4991FRT1	4990 Ohms	Y	Select Alternate Part

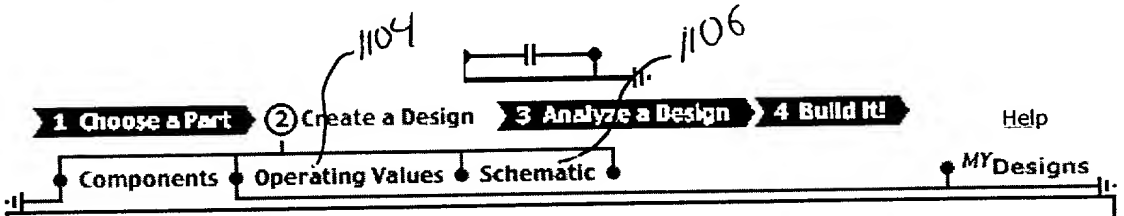
1002

***Components marked "Y" are not required for Thermal Simulation.**

Quick Search | Parametric Search | See Our Disclaimer | Product Tree | Back To Webench

FIG. 10

Title: METHOD TO PERFORM THERMAL SIMULATION OF AN ELECTRONIC CIRCUIT ON A NETWORK
Inventors: Rex Allison; Martin Garrison; Jeffrey Perry
Docket No.: 50019.44US01/P04884



Design: Design#7
Device: LM2679 Mar 17 2001 3:39PM ID: 266796_7

Design Requirements

VinMin = 20.00 V
VinMax = 22.00 V

Output #1
Vout= 5.00 V
Iout= 5.00 A

Select Alternate for Component D1

1108 1110 1102

Please select from the list of available alternates below. Click on the "Update BOM " button when you are done. Update BOM

Alternates	Part # Manufacturer	Thermally Modelled	Forward Voltage Drop	Max Rated Current	Max Voltage Rating	X,Y,Z in mm	Price	Quantity Available
Custom ○		N	Limit = 0.00 V	Limit >= 5.00	Limit >= 26.4	1112		
1 ○	6CWQ03FN International Rectifier		0.45000 V	7.000 A	30.00 V	10.42 6.73 2.38	$0.85	>10 in stock
2 ○	50WQ03FN International Rectifier		0.46000 V	5.500 A	30.00 V	10.42 6.73 2.38	$1.83	>10 in stock
3 ○	12CWQ03FNTRL International Rectifier		0.47000 V	12.00 A	30.00 V	10.42 6.73 2.38	$0.82	>10 in stock
4 ○	50WQ04FN International Rectifier		0.51000 V	5.500 A	40.00 V	10.42 6.73 2.38	$1.33	>10 in stock
5 ◉	12CWQ04FN International Rectifier		0.52000 V	12.00 A	40.00 V	10.42 6.73 2.38	$1.48	>10 in stock
6 ○	6CWQ04FN International Rectifier		0.53000 V	7.000 A	40.00 V	10.42 6.73 2.38	$1.00	>10 in stock
7 ○	50WQ06FN International Rectifier		0.57000 V	5.500 A	60.00 V	10.42 6.73 2.38	$1.07	>10 in stock
8 ○	12CWQ06FN International Rectifier		0.61000 V	12.00 A	60.00 V	10.42 6.73 2.38	$0.72	>10 in stock
9 ○	6CWQ06FNTR International Rectifier		0.61000 V	7.000 A	60.00 V	10.42 6.73 2.38	$1.08	>10 in stock

FIG. 11

National Semiconductor MY WEBENCH™ Online Support

1 Choose a Part | 2 Create a Design | 3 Analyze a Design | 4 Build It! | Help

Components | Operating Values | Schematic | MY Designs

Design: Design#7 Device: LM2679 **Design Requirements** VinMin = 20.00 V VinMax = 22.00 V	Mar 17 2001 3:39:00:000PM Output #1 Vout= 5.00 V Iout= 5.00 A	ID: 266796_7	Choose Operation Copy Rename, Add Notes Print,XML Share this Design

Vin: 22.00 V **Iout:** 5.00 A SUBMIT

Operating Values			
#	**Description**	**Parameter**	**Value**
1	Pulse Width Modulation (PWM) frequency	Frequency	260 kHz
2	Continuous or Discontinuous Conduction mode, inductor current goes to zero in Discontinuous Conduction	Mode	Cont
3	Total Output Power	Pout	25.0 W
4	Vin operationg point	Vin Op	22.00 V
5	Iout operating point	Iout Op	5.00 A

Operating Point at Vin= 22.00 V,5.00 A			
#	**Description**	**Parameter**	**Value**
1	Bode Plot Crossover Frequency, indication of bandwidth of supply	Cross Freq	97.7 kHz
2	Steady State PWM Duty Cycle, range limits from 0 to 100	Duty Cycle	25.8 %
3	Steady State Efficiency	Efficiency	85.3 %
4	IC Junction Temperature	IC Tj	120 øC
5	IC Junction to Ambient Thermal Resistance	ICThetaJA	34.9 øC/W
6	Bode Plot Phase Margin	Phase Marg	71.0 Deg
7	Peak-to-peak ripple voltage	Vout p-p	0.07 V

FIG. 12A

Current Analysis			
#	**Description**	**Parameter**	**Value**
1	Input Capacitor RMS ripple current	Cin IRMS	2.2 A
2	Output Capacitor RMS ripple current	Cout IRMS	0.20 A
3	Peak Current in IC for Steady State Operating Point	IC Ipk	5.5 A
4	ICs Maximum rated peak current	IC Ipk Max	7.4 A
5	Average input current	Iin Avg	2.3 A
6	Inductor ripple current, peak-to-peak value	L Ipp	1.1 A

Power Dissipation Analysis			
#	**Description**	**Parameter**	**Value**
1	Input Capacitor Power Dissipation	Cin Pd	0.43 W
2	Output Capacitor Power Dissipation	Cout Pd	0.0026 W
3	Diode Power Dissipation	Diode Pd	1.9 W
4	IC Power Dissipation	IC Pd	1.4 W
5	Inductor Power Dissipation	L Pd	0.50 W

FIG. 12B

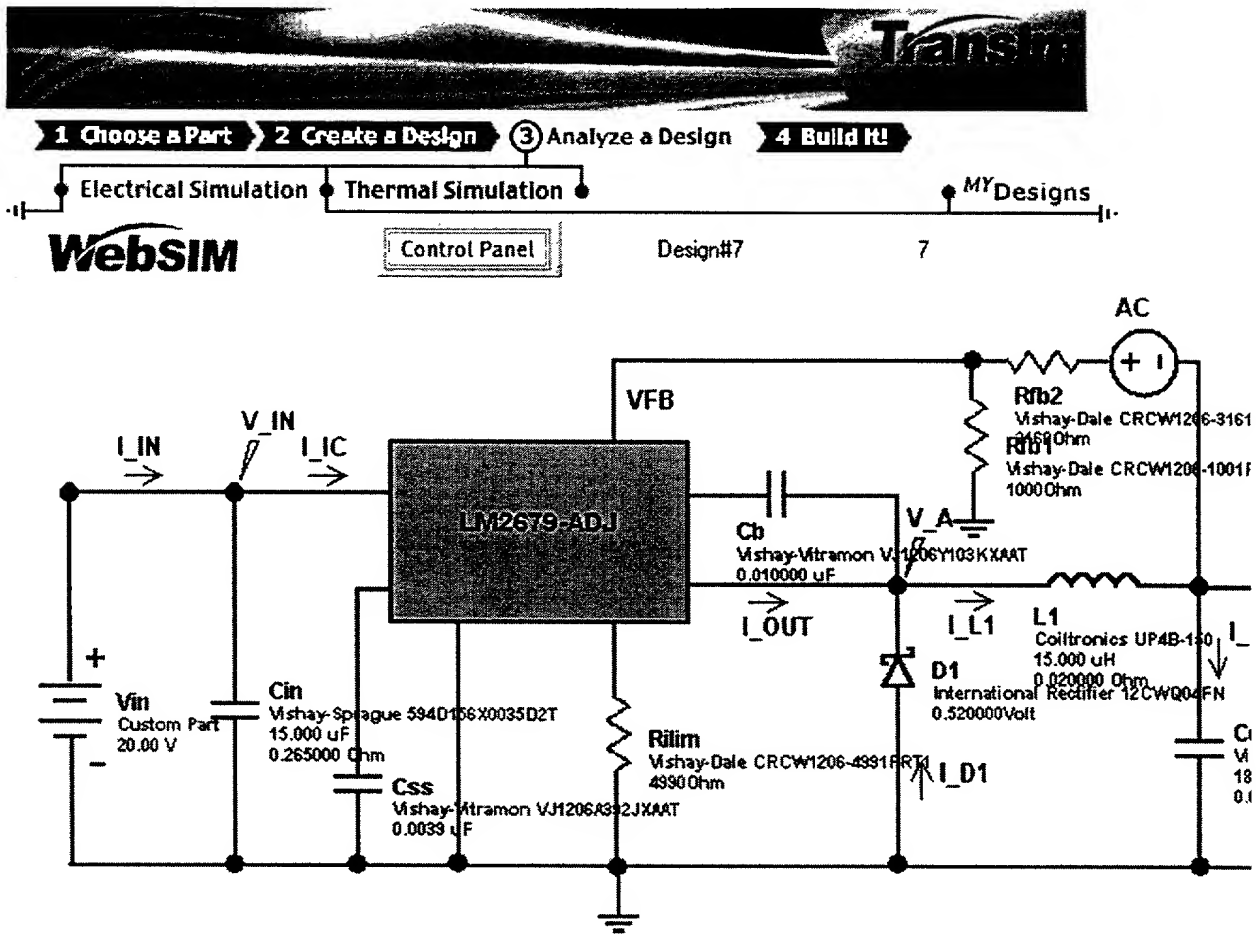
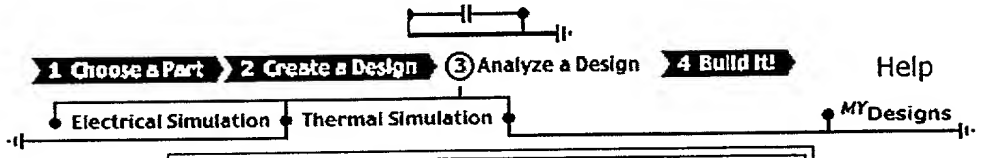

Transim
1 Choose a Part
2 Create a Design
3 Analyze a Design
4 Build It!
Electrical Simulation
Thermal Simulation
MY Designs
WebSIM
Control Panel
Design#7
7
AC
VFB
V_IN
I_IN
I_IC
Rfb2
Vishay-Dale CRCW1206-3161
Rfb1
Vishay-Dale CRCW1206-1001
1000Ohm
LM2679-ADJ
Cb
Vishay-Vitramon VJ1206Y103KXAAT
0.010000 uF
V_A
I_OUT
I_L1
L1
Coiltronics UP4B-150
15.000 uH
0.020000 Ohm
D1
International Rectifier 12CWQ04FN
0.520000Volt
Vin
Custom Part
20.00 V
Cin
Vishay-Sprague 594D156X0035D2T
15.000 uF
0.265000 Ohm
Rilim
Vishay-Dale CRCW1206-4991
4990Ohm
I_D1
Css
Vishay-Vitramon VJ1206A
0.0033 uF

FIG. 13

Title: METHOD TO PERFORM THERMAL SIMULATION OF AN ELECTRONIC CIRCUIT ON A NETWORK
Inventors: Rex Allison; Martin Garrison; Jeffrey Perry
Docket No.: 50019.44US01/P04884



Start a new WebTHERM simulation ~1530

This will take about 20 seconds to create the your board layout to prepare for WebTHERM.
Check the status of previous simulations for this design below.

1510

WebTHERM™ Simulations :

ID	Simulation Name	Status (click to view)	Date	Comments

No WebTHERM™ simulation info.

Click here to see a list of all of your WebTHERM Simulations.

1520

Please click Refresh to get updated status of your simulations.

We will also send you email notification when your simulations are complete. It will contain a URL which can be clicked for viewing your simulations.

Queued time is dependent on the number of requests in the queue.

Processing time for each simulation is estimated about 2-3 minutes.

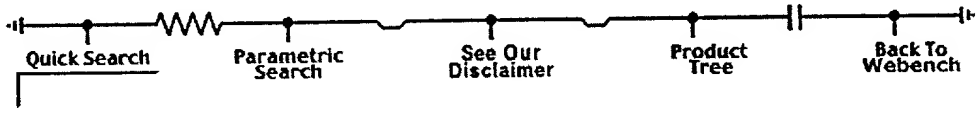


Fig. 14

Title: METHOD TO PERFORM THERMAL SIMULATION
OF AN ELECTRONIC CIRCUIT ON A NETWORK
Inventors: Rex Allison; Martin Garrison; Jeffrey Perry
Docket No.: 50019.44US01/P04884

National Semiconductor MY WEBENCH™ Online Support

1 Choose a Part | 2 Create a Design | ③ Analyze a Design | 4 Build It! Help

Electrical Simulation | Thermal Simulation | MY Designs

Design: Design#7
Device: LM2679 Mar 17 2001 3:39:00:000PM ID: 266796_7

Design Requirements
VinMin = 20.00 V
VinMax = 22.00 V

Output #1
Vout= 5.00 V
Iout= 5.00 A

WebTHERM™ Powered by: FLOMERICS

When you have entered all your data, click here:
SUBMIT for new simulation ~1670

Simulation ID : 4
Name This Simulation: ~1660
Simulation for Design 7

Comments: ~1665

Environment:

Operating Conditions
Vin: 22.00 V **Iout:** 5.00 A

1650
Ambient Temperature
On Bottom: 30 °C **On Top:** 30 °C

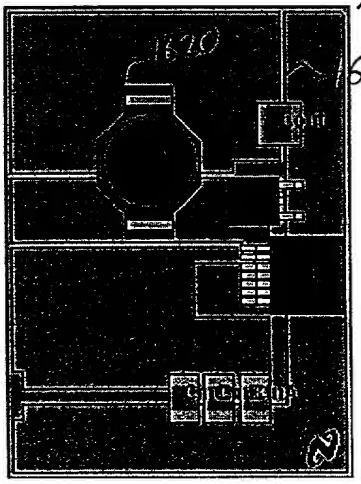
Board Conditions
Copper Weight ~1680
1 OZ.(0.03556 mm)
Board Orientation:
Component Side Up

Air Flow
Direction: **Velocity:**

Edge Temperatures:

Edge 1
☑ Insulated **OR** ~1630
N/A °C

~1610
1620 ~1615



1645 Edge 4
☑ Insulated
OR
N/A °C

Edge 2
☑ Insulated ~1635
OR
N/A °C

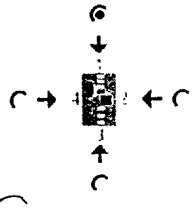
Edge 3
☑ Insulated **OR** ~1640
N/A °C

Fig. 15A

Title: METHOD TO PERFORM THERMAL SIMULATION OF AN ELECTRONIC CIRCUIT ON A NETWORK
Inventors: Rex Allison; Martin Garrison; Jeffrey Perry
Docket No.: 50019.44US01/P04884

1655

Choose the direction of air flow:



Use Fan None

200 LFM

BOM			
Component	Power Dissipation	Manufacturer	Part#
Cin	0.43 W	Vishay-Sprague	594D156X0035D2T
Cout	0.0026 W	Vishay-Sprague	594D187X0016R2T
D1	1.9 W	International Rectifier	12CWQ04FN
IC	1.4 W	National Semiconductor	LM2679
L1	0.50 W	Coiltronics	UP4B-150

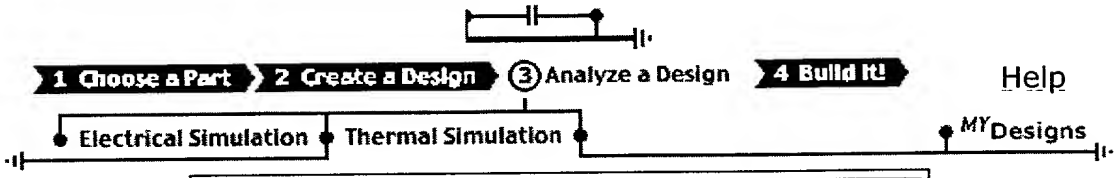
Design Assistant Messages

All components fit!

Quick Search | Parametric Search | See Our Disclaimer | Product Tree | Back To Webench

FIG. 15B

Title: METHOD TO PERFORM THERMAL SIMULATION OF AN ELECTRONIC CIRCUIT ON A NETWORK
Inventors: Rex Allison; Martin Garrison; Jeffrey Perry
Docket No.: 50019.44US01/P04884



Start a new WebTHERM simulation

This will take about 20 seconds to create the your board layout to prepare for WebTHERM.
Check the status of previous simulations for this design below.

WebTHERM™ Simulations :

ID	Simulation Name	Status	Date	Comments
	(click to view)			
7 = Design ID	Simulations for Design ID : 7			Design ID : 7
1	Simulation for Design 7	queued	Mar 17 2001 5:05:45 PM	

1710

Please click Refresh to get updated status of your simulations.

We will also send you email notification when your simulations are complete. It will contain a URL which can be clicked for viewing your simulations.

Queued time is dependent on the number of requests in the queue.

Processing time for each simulation is estimated about 2-3 minutes.

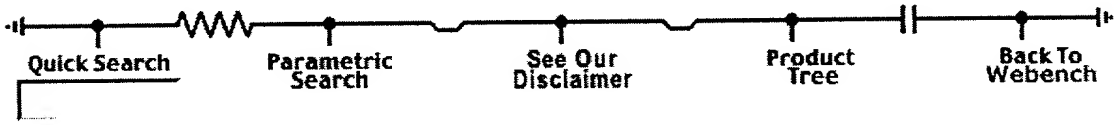
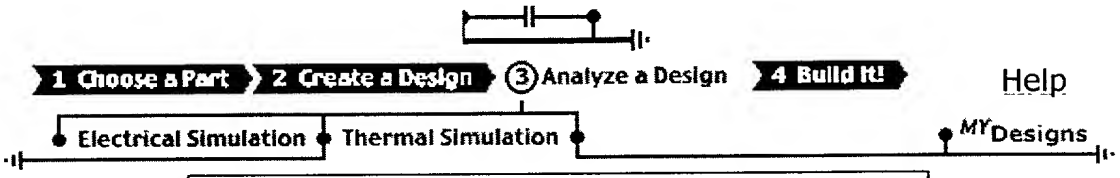


Fig. 16

Title: METHOD TO PERFORM THERMAL SIMULATION OF AN ELECTRONIC CIRCUIT ON A NETWORK
Inventors: Rex Allison; Martin Garrison; Jeffrey Perry
Docket No.: 50019.44US01/P04884



Start a new WebTHERM simulation

This will take about 20 seconds to create the your board layout to prepare for WebTHERM.
Check the status of previous simulations for this design below.

WebTHERM™ Simulations :

ID	Simulation Name	Status (click to view)	Date	Comments
7 = Design ID		Simulations for Design ID : 7		Design ID : 7
1	Simulation for Design 7	processing	Mar 17 2001 5:05:57 PM	

1710

Please click Refresh to get updated status of your simulations.

We will also send you email notification when your simulations are complete. It will contain a URL which can be clicked for viewing your simulations.

Queued time is dependent on the number of requests in the queue.

Processing time for each simulation is estimated about 2-3 minutes.

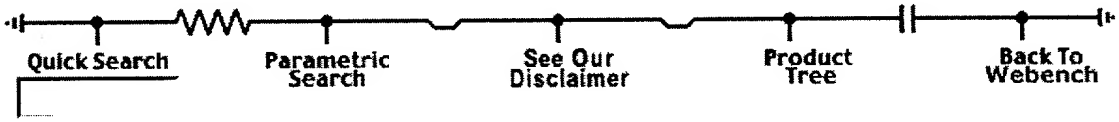
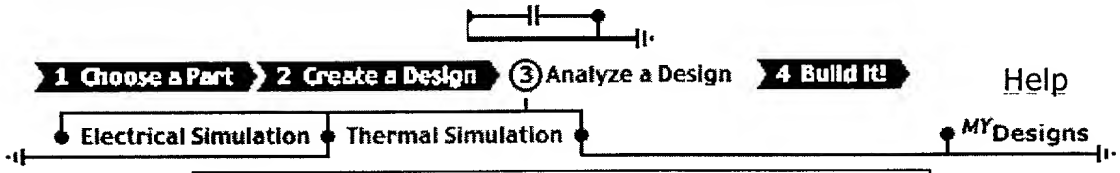


Fig. 17

Title: METHOD TO PERFORM THERMAL SIMULATION OF AN ELECTRONIC CIRCUIT ON A NETWORK
Inventors: Rex Allison; Martin Garrison; Jeffrey Perry
Docket No.: 50019.44US01/P04884



Start a new WebTHERM simulation

This will take about 20 seconds to create the your board layout to prepare for WebTHERM.
Check the status of previous simulations for this design below.

WebTHERM™ Simulations :

ID	Simulation Name (click to view)	Status	Date	Comments
7 = Design ID	Simulations for Design ID : 7			Design ID : 7
1	Simulation for Design 7	completed	Mar 17 2001 5:10:22 PM	

Please click Refresh to get updated status of your simulations.

We will also send you email notification when your simulations are complete. It will contain a URL which can be clicked for viewing your simulations.

Queued time is dependent on the number of requests in the queue.

Processing time for each simulation is estimated about 2-3 minutes.

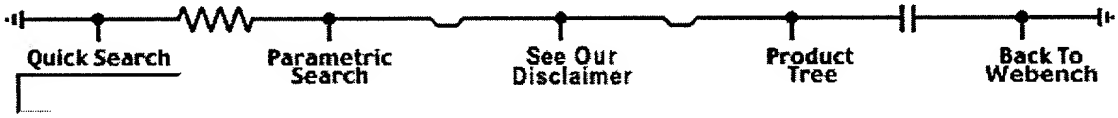


Fig. 18

National Semiconductor MY WEBENCH™ Online Support

1 Choose a Part | 2 Create a Design | 3 Analyze a Design | 4 Build It! | Help

Electrical Simulation | Thermal Simulation | MY Designs

2060

Design: Design#7
Device: LM2679 Mar 17 2001 3:39:00:000PM ID: 266796_7

Design Requirements

VinMin = 20.00 V
VinMax = 22.00 V

Output #1
Vout= 5.00 V
Iout= 5.00 A

WebTHERM™ Powered by: FLOMERICS

Download Flomerics SMARTPART™ model

Do another simulation 2050

Simulation ID : 1
Name This Simulation:
Simulation for Design 7

Environment:

Operating Conditions
Vin: 22.00 V
Iout: 5.00 A

Ambient Temperature
On Bottom: 30 °C
On Top: 30 °C

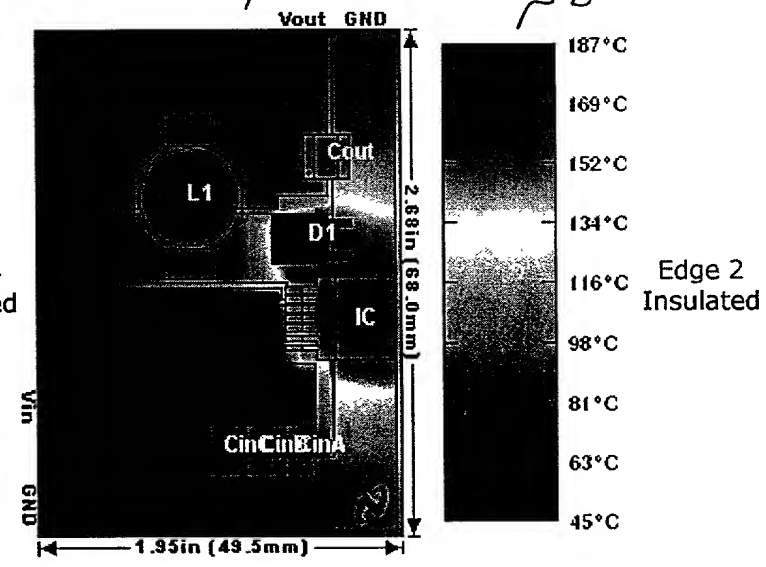
Board Conditions
Copper Weight
0.5 OZ. (0.01778 mm)
Board Orientation:
Component Side Up

Air Flow Direction
Velocity of Air flow: No Fan

Edge Temperatures:

Edge 1 Insulated

2010 2020



Edge 4 Insulated

Edge 2 Insulated

Edge 3 Insulated

Temperature Bar Scaling
Click here to recolor your thermal image.

Max Colorbar Temperature 188 °C
Min Colorbar Temperature 46 °C

2040

FIG. 19A

~2030

Operating Temperatures				
Layer	**Max Temp.**	**Manufacturer**	**Part#**	**Warnings**
Cin	82°C	Vishay-Sprague	594D156X0035D2T	
Cout	92°C	Vishay-Sprague	594D187X0016R2T	
D1 - Diode	188°C	International Rectifier	12CWQ04FN	
IC - Die	174°C	National Semiconductor	LM2679	There is some potential problem with this design.
IC - Top	165°C			
L1 - Inductor	82°C	Coiltronics	UP4B-150	
PCB	182°C			

Design Assistant Messages

All components fit!

FIG. 19B

Title: METHOD TO PERFORM THERMAL SIMULATION OF AN ELECTRONIC CIRCUIT ON A NETWORK
Inventors: Rex Allison; Martin Garrison; Jeffrey Perry
Docket No.: 50019.44US01/P04884

National Semiconductor MY WEBENCH™ Online Support

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2110

Design: Design#7
Device: LM2679 Mar 17 2001 3:39:00:000PM ID: 266796_7

Design Requirements

VinMin = 20.00 V
VinMax = 22.00 V

Output #1
Vout= 5.00 V
Iout= 5.00 A

Powered by: **WebTHERM™ FLOMERICS**

Download Flomerics SMARTPART™ model

Do another simulation

Simulation ID : 3
Name This Simulation: Simulation for Design 7

Environment:

Operating Conditions
Vin: 22.00 V
Iout: 5.00 A

Ambient Temperature
On Bottom: 30 °C
On Top: 30 °C

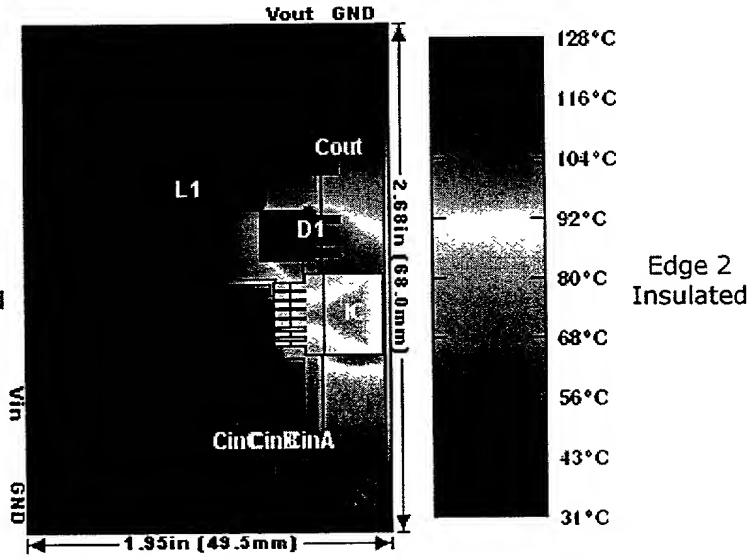
Board Conditions
Copper Weight
0.5 OZ. (0.01778 mm)
Board Orientation:
Component Side Up

Air Flow
Direction of Air flow: Velocity: 400 LFM

Edge Temperatures:

Edge 1 Insulated

Edge 4 Insulated



Edge 2 Insulated

Edge 3 Insulated

Temperature Bar Scaling
Click here to recolor your thermal image.

Max Colorbar Temperature 128 °C
Min Colorbar Temperature 32 °C

FIG. 20A

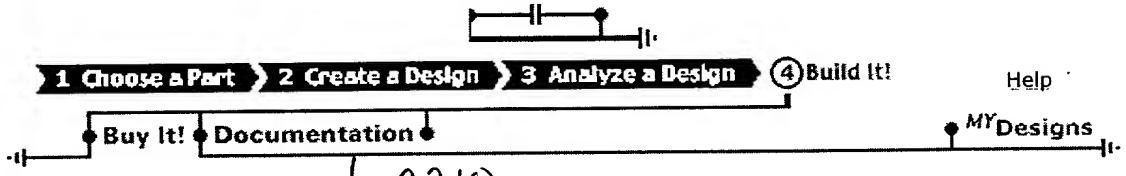
Title: METHOD TO PERFORM THERMAL SIMULATION OF AN ELECTRONIC CIRCUIT ON A NETWORK
Inventors: Rex Allison; Martin Garrison; Jeffrey Perry
Docket No.: 50019.44US01/P04884

Operating Temperatures				
Layer	**Max Temp.**	**Manufacturer**	**Part#**	**Warnings**
Cin	50°C	Vishay-Sprague	594D156X0035D2T	
Cout	50°C	Vishay-Sprague	594D187X0016R2T	
D1 - Diode	128°C	International Rectifier	12CWQ04FN	
IC - Die	112°C	National Semiconductor	LM2679	There is some potential problem with this design.
IC - Top	97°C			
L1 - Inductor	46°C	Coiltronics	UP4B-150	
PCB	123°C			

Design Assistant Messages

All components fit!

FIG 20B



Design : 7

Your design is supported by a Webench Custom Evaluation Kit. Ordering this kit from Pioneer-Standard provides you with everything you need to realize a prototype of your design quickly and at a very low price.

If for some reason you decide not to order the Custom Evaluation Kit you can always order only the IC from us here.

Custom Evaluation Kit Bill of Materials

2220 2230

View Assembly Doc | Order this Kit from Pioneer-Standard >>

Item	Manufacturer Part	Qty	Attributes	Component Name(s)	Pioneer Price	Pioneer Availability
1	International Rectifier 12CWQ04FN	1	VFatlo = 0.52 V	D1	$1.48	> 10 In Stock
2	Keystone 5015	4		TP1, TP2, TP3, TP6	$0.20	> 10 In Stock
3	National Semiconductor 551011367-011	1	Surface Mount, etc	PC Board	$5.00	> 10 In Stock
4	Vishay-Sprague 594D156X0035D2T	3	Cap = 15uF ESR = 0.265 Ohms	Cin	$1.00	> 10 In Stock
5	Vishay-Sprague 594D187X0016R2T	1	Cap = 180uF ESR = 0.065 Ohms	Cout	$1.00	> 10 In Stock
6	Vishay-Dale CRCW1206-1001FRT1	1	Resistance = 1000 Ohms	Rfb1	$0.03	> 10 In Stock
7	Vishay-Dale CRCW1206-3161FRT1	1	Resistance = 3160 Ohms	Rfb2	$0.03	> 10 In Stock
8	Vishay-Dale CRCW1206-4991FRT1	1	Resistance = 4990 Ohms	Rilim	$0.03	> 10 In Stock
9	National Semiconductor LM2679S-ADJ	1	Package=S, Voltage option=ADJ, Topology=Buck	IC	$4.75	> 10 In Stock

Fig. 2A

10	**Coiltronics UP4B-150** 	1	L = 15uH DCR = 0.02 Ohms	L1	$1.50	> 10 In Stock
11	**Vishay-Vitramon VJ1206A392JXAAT**	1	Cap = 0.0039uF	Css	$0.05	> 10 In Stock
12	**Vishay-Vitramon VJ1206Y103KXAAT**	1	Cap = 0.01uF	Cb	$0.05	> 10 In Stock
13	**Vishay-Vitramon VJ1206Y104KXAAT**	1		Cinx	$0.05	> 10 In Stock
				Total	**$17.77**	

Bill of Materials

View Assembly Doc | Order this Kit from Pioneer-Standard >>

Order the IC

- Order the **LM2679S-ADJ** in volume.
- Order a Free Sample

Generic Eval Board for LM2679

- Buy Eval Board for LM2679
- Download Protel File (See Notes below)

The Protel files are saved as Self Extracting Zip Archives. To download a product's Protel file, click on the corresponding "Protel file now" link, and save the link as a file on your computer. Then run the file on your computer (double click). This will automatically decompress the Protel file to your computer's disk. **Note:** You must have Protel software or other software that can read Protel PCB layout files in order to take advantage of these Protel files.

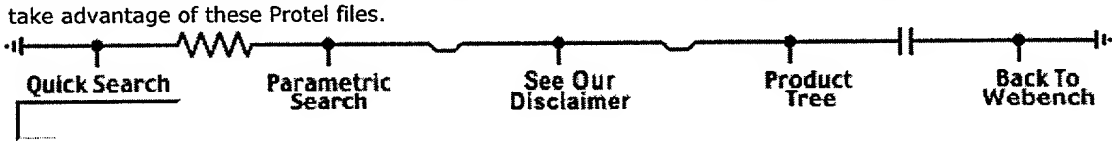


Fig 2B

National Semiconductor MY WEBENCH™

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Buy It! | Documentation | MY Designs

Assembly Document for Your LM2679 Design # : 7

LM2679 SMD Evaluation Board (LM2679BU1PWB)

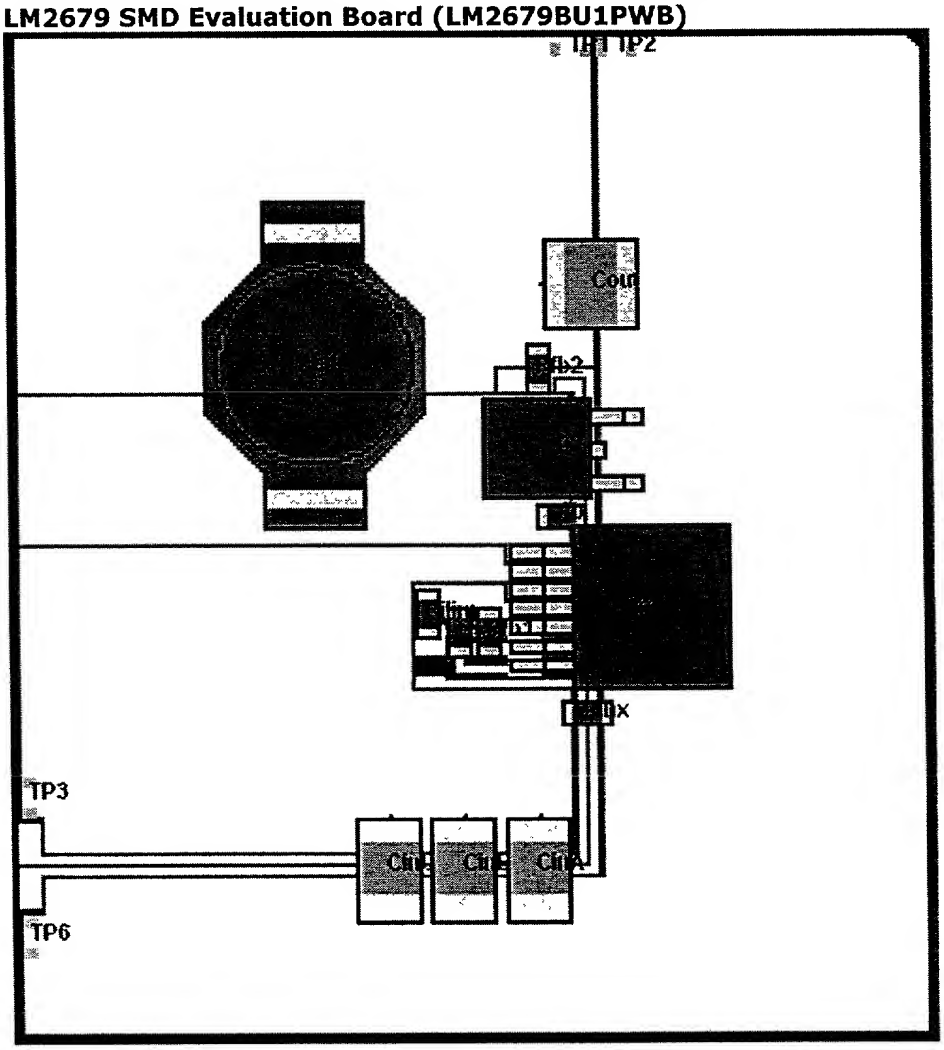


FIGURE 1 - Assembly Diagram

Download the Board Layout in Protel format.

GENERAL DESCRIPTION

Fig. 22A

The LM2679 SMD Evaluation Board is designed to provide a flexible PCB platform for customers to develop and test custom power supply designs using tools available on the POWER.NATIONAL.COM website. The LM2679BU1PWB is a single sided surface mount layout using 1oz copper. The overall board dimensions are 2.475" x 2.700" All components are mounted on the topside copper. WEBENCH™ has automatically placed the components on this board to make sure that the input capacitor Cin (and Cinx) and the diode D1 are as close to the IC as is reasonable minimizing stray circuit inductance. L1 and Cout should also be as close to the IC as reasonable but mostly to minimize the overall dimensions of the required PCB area for the power supply.

The LM2679 SMD Evaluation Board consists of a single layer PCB layout providing major landing areas on the PCB for the Power conversion components: Inductor, Diode, Input and Output Capacitors as well as parameter setting small signal passive (resistors and capacitors) in 1206 packages and surface mount test points. Some components are optional or specific to an application, these are highlighted in the schematic. The PCB layout can be optimized for a specific design and lends itself to be dimensionally scalable (i.e. your particular design may have unused board area that can be "cut out" in the final application. This topic is covered in the PCB Layout Optimization section.

Bill of Materials (BOM).

Item	Manufacturer Part	Qty	Attributes	Component Name(s)
1	**International Rectifier 12CWQ04FN** 	1	VFatlo = 0.52 V	D1
2	**Keystone 5015**	4		TP1, TP2, TP3, TP6
3	**National Semiconductor 551011367-011**	1	Surface Mount, etc	PC Board
4	**Vishay-Sprague 594D156X0035D2T** 	3	Cap = 15uF ESR = 0.265 Ohms	Cin
5	**Vishay-Sprague 594D187X0016R2T** 	1	Cap = 180uF ESR = 0.065 Ohms	Cout
6	**Vishay-Dale CRCW1206-1001FRT1**	1	Resistance = 1000 Ohms	Rfb1
7	**Vishay-Dale CRCW1206-3161FRT1**	1	Resistance = 3160 Ohms	Rfb2
8	**Vishay-Dale CRCW1206-4991FRT1**	1	Resistance = 4990 Ohms	Rilim
9	**National Semiconductor LM2679S-ADJ**	1	Package=S, Voltage option=ADJ, Topology=Buck	IC
10	**Coiltronics UP4B-150** 	1	L = 15uH DCR = 0.02 Ohms	L1
11	**Vishay-Vitramon VJ1206A392JXAAT**	1	Cap = 0.0039uF	Css
12	**Vishay-Vitramon VJ1206Y103KXAAT**	1	Cap = 0.01uF	Cb
13	**Vishay-Vitramon VJ1206Y104KXAAT**	1		Cinx

170.223

SCHEMATIC

The schematic for the LM2679 is shown in FIGURE 2. U1, L1, D1, Cin and Cout are the basic power conversion components. Cinx as a high frequency bypass to the input to the LM2679. Rf1, Rfb2, and Cf form the feedback network for the adjustable version of the LM2679. For Fixed output versions a zero Ohm resistor (jumper) should be used for Rfb2 (Rfb1 and Cf should be left off the board), this can be replaced by a copper trace as shown in the PCB Layout Optimization section. A space is reserved for a pull-down resistor, Ron, for the ON/OFF (Active low) pin, this may be desired if a Tri-State gate is driving this pin. Otherwise, if the ON/OFF pin is left floating, the LM2679 is normally ON.

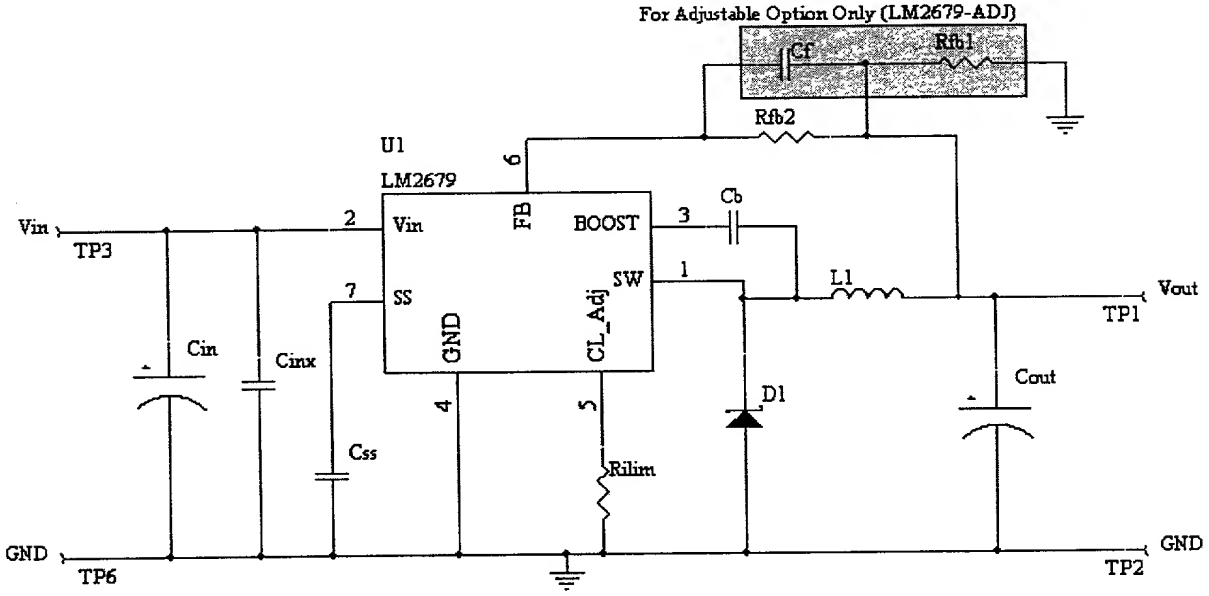


FIGURE 2. - Schematic

Download the Schematic file in Protel format.

Component Testing

Some published data on components in datasheets such as Capacitor ESR and Inductor DC resistance is based on conservative values that will guarantee that the components always exceed the specification. For design purposes it is usually better to work with typical values. Since this data is not always available it is a good practice to measure the Capacitance and ESR values of Cin and Cout, and the inductance and DC resistance of L1 before assembly of the board. Any large discrepancies in values should be electrically simulated to check for instabilities and thermally simulated to make sure critical temperatures are not exceeded.

Soldering components to the Board

If board assembly is done in house it is best to tack down one terminal on the board then solder the other terminal. For the LM2679 the tab on the back of the TO-263 package should be pre-tinned with solder, then tacked into place by one of the pins. To solder the tab town to the board place the iron down on the board while resting against the tab, heating both surfaces simultaneously. Apply light pressure to the top of the plastic case until the solder flows around the part and the part is flush with the PCB. If the solder is not flowing around the board you may need a higher wattage iron (generally 25W to 30W is enough).

Testing

It is best to power up the board by setting the supply voltage to the lowest operating input voltage (Vin min) and set the supplies current limit to zero. With the supply off connect up the supply to Vin and GND. Connect a DVM to Vout and GND. Turn on the supply and slowly turn up the current limit. If the voltage starts to rise on the supply continue increasing the current while watching the output voltage. If the current increases on the supply but the voltage remains near zero there may be a short or a component misplaced on the board. Power down the board and visually inspect for solder bridges and recheck the diode and capacitor polarities. Once the supply is operational then more extensive testing may include full load testing, transient load and line tests to compare with simulation results.

Fig 22C

ARTWORK

FIGURE 3 shows the topside copper and FIGURE 4 shows the bottom side copper.

The intent of the this board is to provide a flexible PCB layout to allow many different designs to be implemented using the same layout. In lower power designs you may find unused board space, that is not needed for electrical or thermal purposes. The overall layout lends itself to shrinking the design by trimming off the outer edges of the board.

Download the GERBER file for this PC Board.

NOTES: UNLESS OTHERWISE SPECIFIED
1. NO FAB SHOP LOGO(DATE CODE REQUIRED)
2. APPLY GREEN (LPI) SOLDERMASK ON BOTH SIDES
3. NO SILKSCREEN
4. ADD UL RATING ON BOTTOM SIDE
5. MATERIAL: FR-4, GREEN
6. BOARD THICKNESS: 0.063 with 1 oz Copper
7. FINISH: TIN/LEAD

MECHANICAL LAYER 55101367-011A

TOP ETCH 55101367-011A

FIGURE 3 - Topside Copper

NOTES: UNLESS OTHERWISE SPECIFIED
1. NO FAB SHOP LOGO(DATE CODE REQUIRED)
2. APPLY GREEN (LPI) SOLDERMASK ON BOTH SIDES
3. NO SILKSCREEN
4. ADD UL RATING ON BOTTOM SIDE
5. MATERIAL: FR-4, GREEN
6. BOARD THICKNESS: 0.063 with 1 oz Copper
7. FINISH: TIN/LEAD

Fig 220

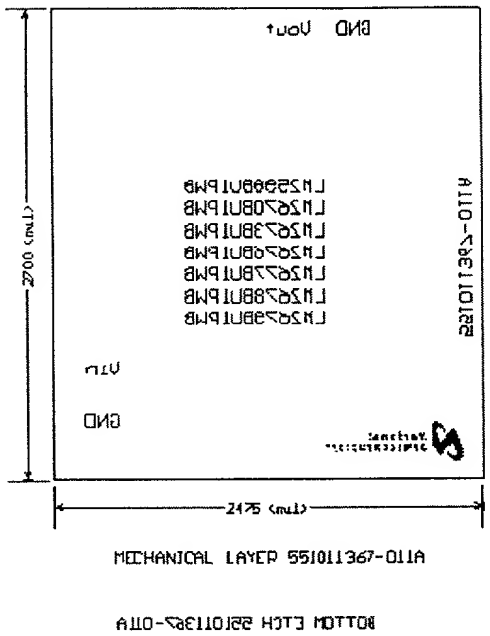


FIGURE 4 - Bottom Side Copper

Downloadable files

Schematic File

The Schematic File in Protel format.

Board Layout File

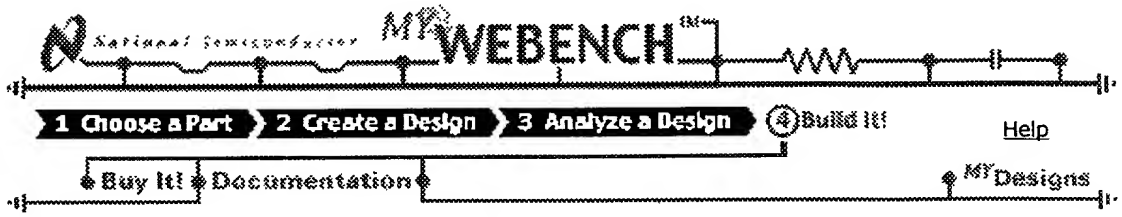
Board Layout in Protel format.

GERBER File

GERBER file for making the PC Board.

Fig 22E

Title: METHOD TO PERFORM THERMAL SIMULATION OF AN ELECTRONIC CIRCUIT ON A NETWORK
Inventors: Rex Allison; Martin Garrison; Jeffrey Perry
Docket No.: 50019.44US01/P04884



Design : 6

WEBENCH Documentation

Assembly Doc.

The Webench Assembly Document describes in detail how to build your design. It contains the specific assembly diagram for your design, a complete bill of materials and other PC board images and assembly instructions. ~2440

Design Doc.

The WEBENCH Design Document provides a single web page describing your entire design including; design specifications, calculated values, WebSIM simulation results and WebTHERM simulation results.

LM2679 Folder ~ 2420

LM2679 Product Folder is full of documentation about the National IC used in your design.

My Orders

My Orders is a list of all of your on-line orders.

WEBENCH Downloads

You can download these files to integrate this design into your local CAD environment.
These file are self-extracting zip files. For the files stored in Protel format you will need the Protel application or equivalent CAD software capable of opening such files.

Schematic File

The Schematic File in Protel format.

Board Layout File

Board Layout in Protel format.

GERBER File

GERBER file for making the PC Board.

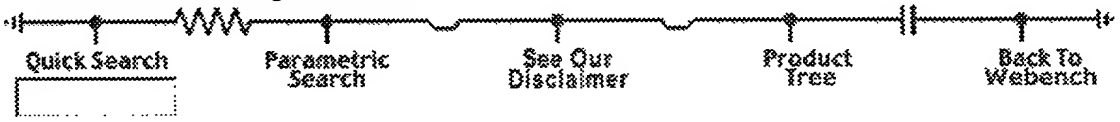
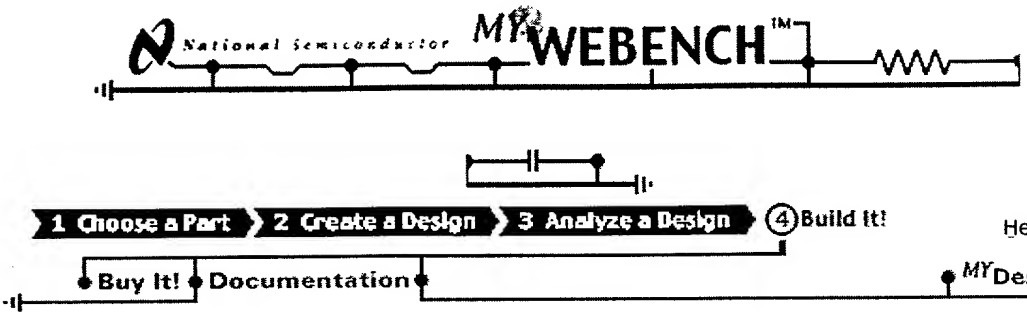


Fig. 23



Design Document for Your LM2679 Design # : 7

Table of Contents

Introduction

Custom power supply designs using tools are available on the POWER.NATIONAL.COM website.

Design Specifications

Design: Design#7
Device: LM2679 Mar 17 2001 3:39PM ID: 266796_7

Design Requirements		Output #1		
VinMin =	20.00 V	Vout=	5.00	V
VinMax =	22.00 V	Iout=	5.00	A

Schematic

Use WebSIM to display your schematic.

Operating Values

Fig 24A

Operating Values

#	Description	Parameter	Value
1	Pulse Width Modulation (PWM) frequency	Frequency	260 kHz
2	Continuous or Discontinuous Conduction mode, inductor current goes to zero in Discontinuous Conduction	Mode	Cont
3	Total Output Power	Pout	25.0 W

Operating Point at Vin= 22.00 V

#	Description	Parameter	Value
1	Bode Plot Crossover Frequency, indication of bandwidth of supply	Cross Freq	97.7 kHz
2	Steady State PWM Duty Cycle, range limits from 0 to 100	Duty Cycle	25.8 %
3	Steady State Efficiency	Efficiency	85.3 %
4	IC Junction Temperature	IC Tj	120 øC
5	IC Junction to Ambient Thermal Resistance	ICThetaJA	34.9 øC/W
6	Bode Plot Phase Margin	Phase Marg	71.0 Deg
7	Peak-to-peak ripple voltage	Vout p-p	0.07 V

Current Analysis

#	Description	Parameter	Value
1	Input Capacitor RMS ripple current	Cin IRMS	2.2 A
2	Output Capacitor RMS ripple current	Cout IRMS	0.20 A
3	Peak Current in IC for Steady State Operating Point	IC Ipk	5.5 A
4	ICs Maximum rated peak current	IC Ipk Max	7.4 A
5	Average input current	Iin Avg	2.3 A
6	Inductor ripple current, peak-to-peak value	L Ipp	1.1 A

Power Dissipation Analysis

#	Description	Parameter	Value
1	Input Capacitor Power Dissipation	Cin Pd	0.43 W
2	Output Capacitor Power Dissipation	Cout Pd	0.0026 W
3	Diode Power Dissipation	Diode Pd	1.9 W
4	IC Power Dissipation	IC Pd	1.4 W
5	Inductor Power Dissipation	L Pd	0.50 W

LM2679 The Selected IC

NSID = LM2679S-ADJ
Topology = Buck
Package = S

BOM - Bill of Materials

Item	Manufacturer Part	Qty	Attributes	Component Name(s)
1	**International Rectifier 12CWQ04FN**	1	VFatlo = 0.52 V	D1
2	**Keystone 5015**	4		TP1, TP2, TP3, TP6

Fig. 24B

3	**National Semiconductor 551011367-011**	1	Surface Mount, etc	PC Board
4	**Vishay-Sprague 594D156X0035D2T**	3	Cap = 15uF ESR = 0.265 Ohms	Cin
5	**Vishay-Sprague 594D187X0016R2T**	1	Cap = 180uF ESR = 0.065 Ohms	Cout
6	**Vishay-Dale CRCW1206-1001FRT1**	1	Resistance = 1000 Ohms	Rfb1
7	**Vishay-Dale CRCW1206-3161FRT1**	1	Resistance = 3160 Ohms	Rfb2
8	**Vishay-Dale CRCW1206-4991FRT1**	1	Resistance = 4990 Ohms	Rilim
9	**National Semiconductor LM2679S-ADJ**	1	Package=S, Voltage option=ADJ, Topology=Buck	IC
10	**Coiltronics UP4B-150**	1	L = 15uH DCR = 0.02 Ohms	L1
11	**Vishay-Vitramon VJ1206A392JXAAT**	1	Cap = 0.0039uF	Css
12	**Vishay-Vitramon VJ1206Y103KXAAT**	1	Cap = 0.01uF	Cb
13	**Vishay-Vitramon VJ1206Y104KXAAT**	1		Cinx

WebTHERM - Thermal Simulation Results

You have performed 3 WebTHERM thermal simulation(s) on this design.
Here are the results of the most recent one.

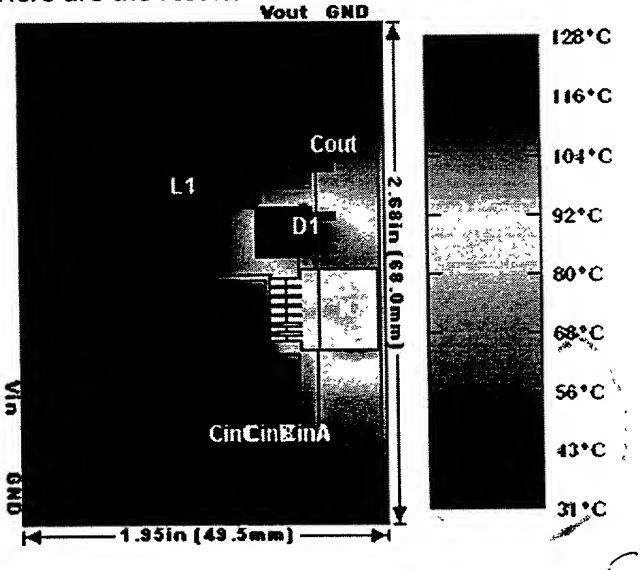


Fig. 24C

Be sure to electrically simulate this design using WebSIM.

Build It!

Webench provides both custom and generic evaluation boards to assist you in the building of prototypes of your design. Additionally, for some designs, it is possible to order the complete BOM (Bill of Materials) on-line using Webench.

A custom evaluation board is available for your design!

Webench provides a custom evaluation board which may be on-line ordered from Pioneer-Standard for designs like yours using National LM2679S-ADJ configured in the Buck topology.

Appendices

A. You have performed 3 thermal simulation(s) on this design.

ID	Simulation Name	Date
1	Simulation for Design 7	Mar 17 2001 5:10 PM
2	Simulation for Design 7	Mar 17 2001 5:19 PM
3	Simulation for Design 7	Mar 17 2001 5:23 PM

B. No electrical simulation(s) performed on this design.

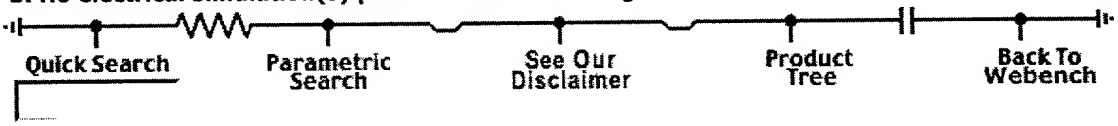


Fig. 24D

Title: METHOD TO PERFORM THERMAL SIMULATION OF AN ELECTRONIC CIRCUIT ON A NETWORK
Inventors: Rex Allison; Martin Garrison; Jeffrey Perry
Docket No.: 50019.44US01/P04884

[Webench™ Designs] [WebTHERM™ Simulations] [WebSIM™ Simulations] [BuildIt Orders]

Tim Sullivan - You have 7 designs stored in your personal workspace.

ID	Design Name	Device	Creation Date	Modification Date	Design Assistant	Comments	Design Operations
7	Design#7	LM2679	Mar 17 2001 3:39PM	Mar 17 2001 3:57PM	power		Modify, Analyze, Build, Add Notes Delete, Share
6	Design#6	LM2679	Mar 15 2001 3:23PM	Mar 15 2001 3:23PM	power		Modify, Analyze, Build, Add Notes Delete, Share
5	Design#5	LM2679	Mar 15 2001 11:41AM	Mar 15 2001 11:44AM	power		Modify, Analyze, Build, Add Notes Delete, Share
4	Design#4	LM2679	Mar 13 2001 9:52AM	Mar 13 2001 10:03AM	power		Modify, Analyze, Build, Add Notes Delete, Share
3	Design#3	LM2679	Mar 13 2001 9:52AM		power		Modify, Analyze, Build, Add Notes Delete, Share
2	Design#2	LM2678	Mar 13 2001 9:50AM		power		Modify, Analyze, Build, Add Notes Delete, Share
1	Design#1	LM2678	Mar 13 2001 9:50AM		power		Modify, Analyze, Build, Add Notes Delete, Share

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Fig. 25